```
0001      * NAME: (PAL-AP)          DOC. 70180311000      RFV. H
0002      *
0003      * PURPOSE
0004      *
0005      *          TO PUNCH SELF-LOADING ORJFCT TAPES OF ANY DESIRED
0006      *     SEGMENT OF MEMORY.
0007      * REVISION HISTORY
0008      *     REV        DATE        ECO NO.
0009      *     H
0010      *     G       01-05-72     10124
0011      *     F       06-08-71      9582
0012      *     E       08-21-68      6098
0013      *     D       02-15-68      5490
0014      *     C       12-19-67      5228
0015      *     B       10-25-67      4776
0016      *     A       10-28-66     RELFASED
0017      *
0018      *
0019      *
0020      *
0021      *
0022      *
0023      *
0024      *
0025      *
0026      * COPYRIGHT 1972 BY HONEYWELL INFORMATION SYSTFMS INC.
0027      ***************************************************************
0028           EJCT
```

```
0029    *
0030    *
0031    * STORAGE
0032    *
0033    *    THIS PROGRAM OCCUPIES LESS THAN ONE SECTOR OF CORE.
0034    *
0035    *
0036    * USE
0037    *
0038    *    PAL-AP IS DISTRIBUTED IN PAL MODE AND IN RELOCATABLE OBJECT FORMAT
0039    *
0040    *      PAL MODE:
0041    *          ALL PAL-FORMAT PROGRAMS MUST BE LOADED IN THE FOLLOWING
0042    *          MANNER:
0043    *            1) THE KEY-IN LOADER (LOCATIONS 1-17) MUST BE MANUALLY
0044    *               SET AS FOLLOWS:          ASR         DIGITRONICS
0045    *
0046    *                1 STA   '57            010057      010057
0047    *                2 OCP   '0001/4        030004      030001
0048    *                3 INA   '1001/4        131004      131001
0049    *                4 JMP   *-1            002003      002003
0050    *                5 SNZ                  101040      101040
0051    *                6 JMP   *-3            002003      002003
0052    *                7 STA   0              010000      010000
0053    *               10 INA   '1001/4        131004      131001
0054    *               11 JMP   *-1            002010      002010
0055    *               12 LGL   8              041470      041470
0056    *               13 INA   '0001/4        130004      130001
0057    *               14 JMP   *-1            002013      002013
0058    *               15 STA*  0              110000      110000
0059    *               16 IRS   0              024000      024000
0060    *               17 SZE                  100040      100040
0061    *
0062    *            2) PLACE THE LEADER PORTION OF THE PROGRAM IN THE PAPER
0063    *               TAPE READER. SET THE P-COUNTER TO 000001 AND PRESS START.
0064    *               (SEE NOTE FOR ASR USERS.)
0065    *
0066    *               NOTE: WHEN USING AN ASR-33, MOMENTARILY PRESS THE START
0067    *               SWITCH ON THE READER AFTER PRESSING THE COMPUTER START
0068    *               BUTTON. WHEN USING AN ASR-35, SET THE MODE SWITCH
0069    *               TO KT. PRESS THE CONTROL KEY (CTRL) AND THE Q KEY
0070    *               SIMULTANEOUSLY, PRESS THE COMPUTER START BUTTON, AND
0071    *               SET THE READER SWITCH TO RUN.
0072    *               THE PROGRAM WILL SELF-LOAD FROM THIS POINT
0073    *               TO THE CORE AREA FROM WHICH IT WAS PUNCHED.
0074    *
0075    *      RELOCATABLE FORMAT
0076    *          1) LOAD THE PROGRAM AS ANY OTHER RELOCATABLE PROGRAM
0077    *          2) TO OUTPUT A PAL MODE TAPE, USE INSTRUCTIONS BELOW,
0078    *             USING LOAD POINT FOR FIRST ADDRESS, AND LOAD POINT
0079    *             PLUS '577 AS LAST ADDRESS.
0080    *
0081    *
0082    *      TO USE PROGRAM:
0083    *          1) MASTER CLEAR
0084    *          2) SET PROGRAM COUNTER TO XX000 WHERE XX IS THE SECTOR
```

```
0085    *          INTO WHICH PAL-AP HAS BEEN LOADED.
0086    *       3) ENTER THE OUTPUT DEVICE CODE INTO THE A-REGISTER. IF
0087    *          THE ASR-33 IS TO BE USED, SET BIT 1 OF THE A-REGISTER
0088    *          AND TURN ON THE PUNCH. IF THE ASR-35 IS TO BE USED,
0089    *          SET BIT 2 OF THE A-REGISTER. IF THE HIGH SPEED
0090    *          PUNCH IS TO BE USED, LEAVE THE A-REGISTER CLEARED.
0091    *       4) PRESS START AND THE PROGRAM WILL HALT.
0092    *       5) ENTER INTO THE A-REGISTER THE FIRST ADDRESS OF THE PROGRAM
0093    *          BEING PUNCHED.
0094    *       6) PRESS START AND THE PROGRAM WILL HALT.
0095    *       7) ENTER INTO THE A-REGISTER THE LAST ADDRESS OF THE
0096    *          PROGRAM BEING PUNCHED.
0097    *       8) PRESS START AND THE SELECTED OUTPUT DEVICE WILL BEGIN
0098    *          PUNCHING TAPE.
0099    *       9) UPON COMPLETION OF THE PUNCH, IF ANOTHER TAPE IS TO BE
0100    *          PUNCHED ON THE SAME DEVICE, CONTINUE FROM STEP 5.
0101    *
0102    *
0103    *    TO GENERATE LOAD AND GO TAPES:
0104    *          SYSTEM BOOTSTRAP TAPES MAY BE PUNCHED BY CHANGING THREE
0105    *          LOCATIONS OF PAL-AP. ADDRESSING IS GIVEN IN OCTAL RELATIVE
0106    *          TO THE FIRST LOCATION OF PAL-AP (IT MUST BE THE FIRST
0107    *          LOCATION OF A SECTOR). LOCATIONS '613 AND '616 ARE BOTH
0108    *          "JMP '632" INSTRUCTIONS, AND SHOULD BE CHANGED TO
0109    *          "JMP* '632" INSTRUCTIONS - I.E. CHANGE FROM JUMP TO JUMP
0110    *          INDIRECT. LOCATION '632 SHOULD BE CHANGED FROM "OCT 12" TO
0111    *          "DAC PTR", WHERE PTR IS THE ABSOLUTE ADDRESS FOR
0112    *          EXECUTION AFTER LOADING THE PAPER TAPE BOOT.
0113    *
0114    *
0115    * METHOD
0116    *
0117    *    PAL-AP IS MADE UP OF TWO SECTIONS. THE PUNCH SECTION (INCLUDING
0118    *    THE BOOTSTRAP) OCCUPIES XX000-XX577. THE LOADER SECTION (READ IN
0119    *    BY THE BOOTSTRAP) OCCUPIES XX600-XX777. IN ADDITION TO THESE
0120    *    THE BOOTSTRAP SECTION WILL LOAD INTO LOCATIONS '20 THROUGH '57,
0121    *    AND WILL BE IN 8-8 FORMAT.
0122    *
0123    *
0124    *    ANY PAL MODE PROGRAM HAS THE FOLLOWING OVERALL STRUCTURE:
0125    *          1) PAL-AP FIRST PUNCHES ITS LOADER SECTION IN 8-8
0126    *             FORMAT FOLLOWED BY TWELVE INCHES OF LEADER.
0127    *          2) NEXT THE DESIRED PROGRAM IS PUNCHED IN PAL FORMAT WHICH
0128    *             IS "RECOGNIZED" BY THE LOADER.
0129    *    THE LOADER ON THE FRONT OF THE TAPE WILL LOAD ITSELF AND
0130    *    THEN WILL LOAD THE PAL-FORMAT PROGRAM.
0131    *
0132    *
0133    *    DATA IS PUNCHED IN BLOCKS OF 50 WORDS EACH. SALIENT
0134    *    CHARACTERISTICS OF THE BLOCK STRUCTURE AREA ARE AS FOLLOWS:
0135    *          1) A START OF MESSAGE CHARACTER (OCTAL 201) IS
0136    *             PUNCHED AT THE BEGINNING OF EACH BLOCK.
0137    *          2) FOLLOWING THIS, THE ADDRESS OF THE FIRST MEMORY
0138    *             LOCATION IS PUNCHED.
0139    *          3) EACH BLOCK IS ENDED BY:
0140    *             A) A CHECKSUM. THIS CONSISTS OF A WORD WHICH
```

```
0141                *              IS THE EXCLUSIVE OR OF ALL WORDS PUNCHED
0142                *              PLUS A WORD COUNT AND A BLOCK COUNT.
0143                *              (THE FIRST BLOCK IS ZERO AND EACH ONE THERE-
0144                *              AFTER IS INCREMENTED BY ONE.)  THE
0145                *              CHECKSUM IS ROTATED RIGHT ONE BIT EACH
0146                *              TIME ANOTHER WORD IS ADDED TO IT.
0147                *           B) AN END OF MESSAGE CHARACTER (OCTAL 223).
0148                *              THE EOM IS FOLLOWED BY A RUBOUT CHARACTER (OCTAL 377)
0149                *         4) SIX FRAMES OF LEADER ARE PUNCHED BETWEEN BLOCKS
0150                *            AND TWELVE INCHES OF LEADER ARE PUNCHED
0151                *            AT THE BEGINNING AND END OF THE PROGRAM.
0152                *
0153                *       THE FORMAT OF THE PUNCHED WORDS IS AS FOLLOWS:
0154                *          1) NON-ZERO WORDS ARE PUNCHED IN "INVISIBLE CODE".
0155                *             EACH 16-BIT WORD IS WRITTEN AS A FOUR-BIT AND
0156                *             TWO SIX-BIT CHARACTERS ON TAPE. THE FOUR-BIT
0157                *             CHARACTER REPRESENTS THE HIGH-ORDER FOUR
0158                *             BITS OF THE WORD. EACH SIX-BIT CHARACTER
0159                *             HAS THE HIGH-ORDER BIT IN CHANNEL EIGHT AND THE
0160                *             FIVE LOW-ORDER BITS IN CHANNELS FIVE THROUGH
0161                *             ONE. ORDINARILY, NOTHING IS WRITTEN IN CHANNELS
0162                *             EIGHT THROUGH FIVE OF THE FOUR-BIT CHARACTER
0163                *             OR IN CHANNELS SIX AND SEVEN OF THE SIX-BIT
0164                *             CHARACTERS.
0165                *          2) EIGHT CHARACTERS CAUSE SPECIAL ACTION BY THE ASR.
0166                *             THESE ARE 023 AND 223 (X-OFF). 021 AND 221 (X-ON). 012
0167                *             AND 212 (LINE FEED). 005 AND 205 (WRU). THESE ARE
0168                *             TRANSLATED INTO 177 AND 377. 176 AND 376. 175 AND
0169                *             375. 174 AND 374. RESPECTIVELY. IN THE CASE OF EACH OF
0170                *             THESE CHARACTERS, CHANNELS SIX AND SEVEN ARE PUNCHED.
0171                *          3) WHEN ONE OR MORE CONSECUTIVE ZERO WORDS ARE
0172                *             ENCOUNTERED IN MEMORY. THEY ARE REPRESENTED BY
0173                *             ONE PUNCHED WORD. THIS CONSISTS OF THE TWO'S COMPLEMENT
0174                *             OF THE NUMBER OF CONSECUTIVE ZERO WORDS ENCOUNTERED. IN
0175                *             ORDER TO DISTINGUISH THESE Z-COUNT WORDS. CHANNEL EIGHT
0176                *             OF THE HIGH-ORDER (FOUR-BIT) CHARACTER IS PUNCHED
0177                *
0178                *
0179                *          NOTE: THE WORD COUNT CONSISTS OF THE TOTAL NUMBER OF
0180                *       WORDS ENCOUNTERED WHILE PUNCHING A BLOCK. INCLUDING ALL
0181                *       ZERO WORDS.
0182                *
0183                *
0184                *
0185                ********************************************************************
0186                     REL
0187                     EXD                        ENTER EXTENDED MODE
0188                *                               LOAD A WITH DEVICE CODE
0189 00000  000013      EXA                        ENABLE EXTENDED ADDRESSING
0190 00001  0 04 00460  STA   CODE                 SAVE DEVICE CODE
0191 00002  140040  BEGN CRA
0192 00003  000000      HLT                        ENTER FIRST ADDRESS
0193 00004  0 04 00444  STA   FADD                 SAVE IT
0194 00005  140040      CRA
0195 00006  000000      HLT                        ENTER LAST ADDRESS
0196 00007  0 04 00445  STA   LADD                 SAVE IT
```

```
0197 00010    0 02 00460       LDA   CODE       PICKUP DEVICE CODE
0198 00011    101400           SMI              IS ASR-33 IN USE
0199 00012    0 01 00033       JMP   TF35       NO.
0200 00013    140040           CRA
0201 00014    0 04 00461       STA   PON
0202 00015    0 04 00462       STA   RUB
0203 00016    0 02 00427 SOCP  LDA   EASR
0204 00017    0 04 00056       STA   EPNC
0205 00020    0 02 00430       LDA   PASR       REPLACE OTA '2 WITH OTA '4.
0206 00021    0 04 00412 SOTA  STA   TPON+2     SET OTA'S
0207 00022    0 04 00415       STA   TPON+5     SET OTA'S
0208 00023    0 04 00131       STA   BGBL+5     SET OTA'S
0209 00024    0 04 00271       STA   XOF+2      SET OTA'S
0210 00025    0 04 00274       STA   XOF+5      SET OTA'S
0211 00026    0 04 00071       STA   LLOP+1     SET OTA'S
0212 00027    0 04 00363       STA   OK+1       SET OTA'S
0213 00030    0 04 00375       STA   P+2        SET OTA'S
0214 00031    0 04 00117       STA   QRUB+1
0215 00032    0 01 00052       JMP   CONT
0216 00033    0416 77    TF35  ALR   1          TEST FOR ASR-35
0217 00034    101400           SMI              IS ASR-35 IN USE
0218 00035    0 01 00043       JMP   HISP       NO.
0219 00036    0 02 00473       LDA   ='222      INITIALIZE PUNCH
0220 00037    0 04 00461       STA   PON
0221 00040    0 02 00472       LDA   ='377      AND RUBOUT CODES
0222 00041    0 04 00462       STA   RUB
0223 00042    0 01 00016       JMP   SOCP
0224 00043    140040     HISP  CRA              HIGH SPEED PUNCH IN USE
0225 00044    0 04 00461       STA   PON
0226 00045    0 04 00462       STA   RUB
0227 00046    0 02 00431       LDA   EBRP       OCP '2
0228 00047    0 04 00056       STA   EPNC
0229 00050    0 02 00432       LDA   PBRP       OTA '2
0230 00051    0 01 00021       JMP   SOTA       STORE IT AWAY
0231 00052    140040     CONT  CRA
0232 00053    0 04 00446       STA   BLCT       BLOCK COUNT
0233 00054    0 04 00450       STA   ZCNT       AND ZCOUNT
0234 00055    0 04 00443       STA   Z
0235 00056    14 0002   EPNC  OCP   '2         ENABLE PUNCH
0236 00057    0 10 00410       JST   TPON       TURN PUNCH ON
0237 00060    0 01 00077       JMP   LDR        GO TO PUNCH LEADER
0238 00061    0 000000   LEAD  DAC   **         ROUTINE TO PUNCH 12 INCHES OF LEADER
0239 00062    0 02 00436       LDA   N120       SET INDEX FOR 120 FRAMES
0240 00063    0 04 00453       STA   NDX        AND GO TO
0241 00064    0 01 00070       JMP   *+4        PUNCH
0242 00065    0 000000   PNC   DAC   **
0243 00066    0 02 00065       LDA   PNC        STORE RETURN ADDRESS
0244 00067    0 04 00061       STA   LEAD       IN LEAD
0245 00070    140040    LLOP   CRA              LEADER LOOP
0246 00071    74 0002          OTA   '2         OUTPUT LEADER
0247 00072    0 01 00071       JMP   *-1
0248 00073    0 12 00453       IRS   NDX
0249 00074    0 01 00070       JMP   *-4
0250 00075    0 04 00447       STA   WDCT
0251 00076   -0 01 00061       JMP*  LEAD       RETURN
0252 00077    0 10 00061  LDR  JST   LEAD       GO TO PUNCH 12 INCHES OF LEADER
```

```
0253 00100   0 02 00471      LDA    ='52          GET FIRST RETURN FOR CHAR SUBROUTINE
0254 00101   0 04 00731      STA    CHAR
0255 00102   0 04 00704      STA    SWCH          INITIALIZE TO PRISTINE CONDITION
0256 00103   0 04 00715      STA    WORD          INITIALIZE TO PRISTINE CONDITION
0257 00104   0 02 00434      LDA    NBL1          LENGTH OF FIRST LEVEL BOOT (NEG)
0258 00105   0 04 00453      STA    NDX           FIRST
0259 00106   0 02 00440      LDA    LOAD          BLOCK
0260 00107   0 04 00401      STA    PN88          OF
0261 00110   0 10 00400      JST    PN            PUNCH BL 1
0262 00111   0 12 00401      IRS    PN88          OMIT THE OCP OF BL2
0263 00112   0 12 00401      IRS    PN88          OMIT THE INA OF BL2
0264 00113   0 02 00437      LDA    NBL2          LENGTH OF SECOND LEVEL BOOT (NEG)
0265 00114   0 04 00453      STA    NDX           BLOCK
0266 00115   0 10 00400      JST    PN            PUNCH SECOND LEVEL BOOT
0267 00116   0 02 00472 ORUB LDA    ='377
0268 00117   74 0002         OTA    '2
0269 00120   0 01 00117      JMP    *-1
0270 00121   0 10 00410      JST    TPON
0271 00122   0 10 00061      JST    LEAD          TURN PUNCH ON, PUNCH LEADER
0272 00123   0 01 00125      JMP    BGBL+1
0273                    *
0274                    *          BEGIN PUNCHING BLOCK OF CHARACTERS
0275                    *
0276 00124   0 10 00410 BGBL JST    TPON
0277 00125   0 02 00433      LDA    N6            BEGIN BLOCK. SET INDEX FOR
0278 00126   0 04 00453      STA    NDX           SIX FRAMES OF LEADER
0279 00127   0 10 00065      JST    PNC           AND PUNCH
0280 00130   0 02 00441      LDA    SOM           LOAD START-OF-MESSAGE
0281 00131   74 0002         OTA    '2            PUNCH
0282 00132   0 01 00131      JMP    *-1           (DELAY IF PUNCH NOT READY)
0283 00133   0 02 00435      LDA    N50           INITIALIZE
0284 00134   0 04 00451      STA    PNCT          PUNCH COUNT
0285 00135   0 02 00446      LDA    BLCT          INITIALIZE CHECKSUM
0286 00136   0 04 00452      STA    CKSM          WITH BLOCKCOUNT
0287 00137   0 12 00446      IRS    BLCT          AND INCREMENT BLOCKCOUNT
0288 00140   0 02 00444      LDA    FADD          LOAD FIRST ADDRESS OF BLOCK
0289 00141   0 07 00470      SUB    =1
0290 00142   0 10 00277      JST    LOOP          AND PUNCH IT.
0291 00143   0 02 00443      LDA    Z
0292 00144   0 04 00450      STA    ZCNT
0293 00145   0 02 00455      LDA    SAVE
0294 00146   0 01 00150      JMP    *+2
0295 00147   0 12 00444 MOVE IRS    FADD          INCREMENT FIRST ADDRESS
0296 00150   0 12 00447      IRS    WDCT          AND WORD COUNT
0297 00151   0 05 00452      ERA    CKSM          UPDATE CHECKSUM WITH
0298 00152   0406 77         ARR    1
0299 00153   0 04 00452      STA    CKSM          CHARACTER JUST PUNCHED
0300 00154   0 12 00451      IRS    PNCT          INCREMENT PUNCHCOUNT
0301 00155   0 01 00157      JMP    *+2           50 WORDS NOT YET PUNCHED
0302 00156   0 01 00226      JMP    ENBL          50 WORDS PUNCHED-END BLOCK
0303 00157   0 10 00207      JST    DECD          CHECK IF ZCOUNT ZERO
0304 00160   0 01 00221      JMP    GO            NO,PUNCH STORED WORD
0305 00161  -0 02 00444      LDA*   FADD          YES. LOAD NEXT WORD FROM MEMORY
0306 00162   100040          SZE                  IS IT ZERO
0307 00163   0 01 00201      JMP    NZZZ          NO
0308 00164   0 12 00450      IRS    ZCNT          YES,INCREMENT ZCOUNT
```

```
0309 00165   0 12 00447      IRS   WDCT        AND WORDCOUNT
0310 00166   0 12 00444      IRS   FADD        AND FIRST ADDRESS
0311 00167   0 12 00451      IRS   PNCT        BUMP WORD COUNT
0312 00170   0 01 00213      JMP   CKLA        CHECK FOR LAST ADDRESS
0313 00171   0 02 00450      LDA   ZCNT        GO TERMINATE BLOCK
0314 00172   0 10 00277      JST   LOOP        PUNCH NO. OF ZERO WORDS
0315 00173   0 05 00452      ERA   CK$M        CALCULATE NEW CKSM
0316 00174   0406 77         ARR   1           *
0317 00175   0 04 00452      STA   CKSM        SAVE IT
0318 00176   140040         CRA              RESET ZCOUNT
0319 00177   0 04 00450      STA   ZCNT        DO IT
0320 00200   0 01 00226      JMP   ENBL        GO FINISH BLOCK
0321 00201   0 04 00454 NZZZ STA   WD          WORD NOT ZERO, STORE IT
0322 00202   0 02 00450      LDA   ZCNT        CHECK ZCOUNT
0323 00203   101040         SNZ              IS IT ZERO
0324 00204   0 01 00223      JMP   GO+2
0325 00205   0 10 00277      JST   LOOP        NO, TAKE ZCOUNT. PUNCH.
0326 00206   0 01 00151      JMP   MOVE+2      RETURN
0327 00207   0 000000 DECD DAC   **          DECISION SUBROUTINE
0328 00210   0 02 00450      LDA   ZCNT        CHECK ZCOUNT
0329 00211   101040         SNZ              IS IT ZERO
0330 00212   0 12 00207      IRS   DECD        YES, INCREMENT RETURN ADDRESS
0331 00213   0 02 00444 CKLA LDA   FADD        NO, CHECK
0332 00214   0 07 00470      SUB   =1
0333 00215   0 05 00445      ERA   LADD        LAST
0334 00216   100040         SZE              ADDRESS
0335 00217  -0 01 00207      JMP*  DECD        NOT REACHED, RETURN
0336 00220   0 01 00263      JMP   CHEK        LAST ADDRESS REACHED. CHECK ZCOUNT
0337 00221   140040      GO CRA              RESTORE
0338 00222   0 04 00450      STA   ZCNT        ZCOUNT TO ZERO
0339 00223   0 02 00454      LDA   WD          TAKE STORED WORD
0340 00224   0 10 00277      JST   LOOP        AND PUNCH IT
0341 00225   0 01 00147      JMP   MOVE        AND CONTINUE.
0342                    *
0343                    *              END BLOCK
0344                    *
0345 00226   0 02 00450 ENBL LDA   ZCNT
0346 00227   0 04 00443      STA   Z
0347 00230   140040         CRA
0348 00231   0 04 00450      STA   ZCNT
0349 00232   0 02 00447      LDA   WDCT
0350 00233   0 05 00452      ERA   CKSM        WITH CHECKSUM
0351 00234   0 10 00277      JST   LOOP        AND PUNCH
0352 00235   0 10 00267      JST   XOF         PUNCH XOFF
0353 00236   0 01 00124      JMP   BGBL        BEGIN NEW BLOCK
0354 00237   0 10 00277 ZNZ JST   LOOP        ZCOUNT NOT ZERO, PUNCH IT.
0355 00240   0 05 00452      ERA   CKSM        UPDATE
0356 00241   0406 77         ARR   1
0357 00242   0 04 00452      STA   CKSM        CHECKSUM
0358 00243   140040         CRA
0359 00244   0 04 00450      STA   ZCNT
0360 00245   0 02 00447      LDA   WDCT        LOAD WORD COUNT AND
0361 00246   0 05 00452      ERA   CKSM        ERA IT WITH CHECKSUM
0362 00247   0 10 00277      JST   LOOP        PUNCH CHECKSUM
0363 00250   0 10 00267      JST   XOF         PUNCH TWO XOF'S
0364 00251   0 10 00410      JST   TPON        TURN PUNCH ON
```

```
0365 00252   0 10 00267        JST   XOF        SECOND XOF
0366 00253   0 10 00410        JST   TPON
0367 00254   0 10 00061        JST   LEAD       TURN PUNCH ON, PUNCH LEADER
0368 00255   0 02 00460        LDA   CODE       PICKUP OUTPUT DEVICE
0369 00256   0416 77           ALR   1          CHECK IF ASR-35
0370 00257   101400            SMI              *
0371 00260   100000            SKP              EITHER 33 OR H/S
0372 00261   0 10 00267        JST   XOF        STOP PUNCH ON ASR-35
0373 00262   0 01 00371        JMP   DONE       GO WRAP UP
0374 00263   0 02 00450 CHEK   LDA   ZCNT       IS ZCOUNT 7FRO
0375 00264   100040            SZE
0376 00265   0 01 00237        JMP   ZNZ        NO, PUNCH IT
0377 00266   0 01 00245        JMP   ZNZ+6
0378 00267   0 000000   XOF    DAC   **         PUNCH XOFF ROUTINE
0379 00270   0 02 00442        LDA   XOFF       LOAD XOFF
0380 00271   74 0002           OTA   '2         PUNCH
0381 00272   0 01 00271        JMP   *-1        (DELAY IF PUNCH NOT READY)
0382 00273   0 02 00472        LDA   ='377
0383 00274   74 0002           OTA   '2
0384 00275   0 01 00274        JMP   *-1
0385 00276   -0 01 00267       JMP*  XOF        RETURN
0386 00277   0 000000   LOOP   DAC   **         MAIN PUNCH LOOP
0387 00300   0 10 00306        JST   TEST       IS WORD A 7COUNT
0388 00301   0 05 00467        ERA   ='100000   YES, PUT ONE IN HIGH ORDER BIT
0389 00302   0 10 00331        JST   PNCH       PUNCH
0390 00303   0 10 00331        JST   PNCH       THREE
0391 00304   0 10 00331        JST   PNCH       CHARACTERS
0392 00305   -0 01 00277       JMP*  LOOP       RETURN
0393 00306   0 000000   TEST   DAC   **
0394 00307   0 04 00455        STA   SAVE       SAVE WORD
0395 00310   0 02 00450        LDA   ZCNT
0396 00311   101040            SNZ
0397 00312   0 01 00317        JMP   *+5
0398 00313   0 05 00466        ERA   =-1        TAKE TWO'S
0399 00314   0 06 00470        ADD   =1         COMPLEMENT
0400 00315   0 04 00455        STA   SAVE       UPDATE SAVE
0401 00316   0 01 00321        JMP   *+3        CONTINUE
0402 00317   0 12 00306        IRS   TEST       ZCOUNT 7FRO, CONTINUE
0403 00320   0 02 00455        LDA   SAVE       REGAIN SAVE
0404 00321   0406 76           ARR   2          POSITION CHARACTER
0405 00322   0 04 00455        STA   SAVE
0406 00323   0 03 00465        ANA   ='36000    CLEAR TO CHARACTER
0407 00324   -0 01 00306       JMP*  TEST       RETURN
0408 00325   0404 66    HOB    LGR   10         CHANGE HIGH-ORDER
0409 00326   0 03 00464        ANA   ='37       BIT FROM CHANNEL 6
0410 00327   0 05 00463        ERA   ='200      TO CHANNFL 8
0411 00330   0 01 00335        JMP   *+5        AND GO TO PUNCH
0412 00331   0 000000   PNCH   DAC   **         PUNCH ROUTINE
0413 00332   100400            SPL              CHECK FOR
0414 00333   0 01 00325        JMP   HOB        HIGH ORDER BIT
0415 00334   0404 66           LGR   10         POSITION CHARACTER
0416 00335   0 04 00456        STA   SAVA       STORE IT
0417 00336   0 03 00464        ANA   ='37       SET UP FOR TRANSLATION CHECK
0418 00337   0 04 00457        STA   SAVB       STORE
0419 00340   0 02 00420        LDA   ADC1       LOAD ADDRESS OF TABLE
0420 00341   0 04 00421        STA   ADC2       SETUP FOR CHECK
```

```
0421 00342   -0 02 00421        LDA*  ADC2       LOAD FROM TABLE
0422 00343   101040             SNZ              CHECK FOR END OF TABLE
0423 00344   0 01 00362         JMP   OK         DONE. NO TRANSLATION NEEDED
0424 00345   0 03 00472         ANA   ='377      CLEAR 9 HIGH-ORDER BITS
0425 00346   0 05 00457         ERA   SAVB       CHECK FOR
0426 00347   101040             SNZ              MATCH
0427 00350   0 01 00353         JMP   TRNS       YES, TRANSLATE
0428 00351   0 12 00421         IRS   ADC2       NO. INCREMENT ADDRESS
0429 00352   0 01 00342         JMP   *-8        AND RETURN.
0430 00353   0 02 00456  TRNS LDA  SAVA          PICK UP ORIGINAL CHARACTER
0431 00354   0 03 00463         ANA   ='200      CLEAR ALL BUT BIT 8
0432 00355   0 04 00456         STA   SAVA       SAVE BIT
0433 00356   -0 02 00421        LDA*  ADC2       PICK UP SUBROUTINE
0434 00357   0404 70            LGR   8          CHARACTER
0435 00360   0 05 00456         ERA   SAVA       OBTAIN CORRECT BIT 8
0436 00361   0 01 00363         JMP   *+2        PUNCH
0437 00362   0 02 00456  OK   LDA  SAVA          NO TRANSLATION, GET CHARACTER
0438 00363   74 0002            OTA   '2         PUNCH
0439 00364   0 01 00363         JMP   *-1        (DELAY IF PUNCH NOT READY)
0440 00365   0 02 00455         LDA   SAVE       POSITION WORD
0441 00366   0416 72            ALR   6          FOR NEXT CHARACTER
0442 00367   0 04 00455         STA   SAVE       STORE CHARACTER
0443 00370   -0 01 00331        JMP*  PNCH       AND RETURN
0444 00371   14 0102      DONE OCP  '102
0445 00372   0 01 00002         JMP   BEGN       RESTART IF DESIRED
0446 00373   0 000000     P   DAC   **
0447 00374   0406 70            ARR   8
0448 00375   74 0002            OTA   '2         PUNCH
0449 00376   0 01 00375         JMP   *-1
0450 00377   -0 01 00373        JMP*  P
0451 00400   0 00 00000   PN   PZE   **
0452 00401   0 00 00000   PN88 PZE   **
0453 00402   0 10 00373         JST   P          PUNCH LOAD PROGRAM
0454 00403   0 10 00373         JST   P          IN 8-8 FORMAT
0455 00404   0 12 00401         IRS   PN88
0456 00405   0 12 00453         IRS   NDX
0457 00406   0 01 00401         JMP   PN88
0458 00407   -0 01 00400        JMP*  PN
0459 00410   0 000000   TPON DAC   **            TURN PUNCH ON
0460 00411   0 02 00461         LDA   PON        OUTPUT '222
0461 00412   74 0002            OTA   '2         IF ASR-35 IN USE.
0462 00413   0 01 00412         JMP   *-1
0463 00414   0 02 00462         LDA   RUB        OUTPUT '377
0464 00415   74 0002            OTA   '2         IF ASR-35 IN USE.
0465 00416   0 01 00415         JMP   *-1
0466 00417   -0 01 00410        JMP*  TPON
0467 00420   0 000422     ADC1 DAC  C1           ADDRESS OF C1
0468 00421                ADC2 BSS  1
0469                      *
0470                      * TRANSLATION TABLE.  ILLEGAL CHARACTER (7 LOW ORDER BITS)
0471                      * IN RIGHT-HAND HALF, AND SUBSTITUTION CHARACTER (7 LOW ORDER BITS)
0472                      * IN LEFT-HAND HALF.
0473                      *
0474 00422   077423       C1   OCT   77423,77021,76412,76005,0
     00423   077021
     00424   076412
```

```
       00425     076005
       00426     000000
0475                        *
0476   00427    14 0104    EASR OCP    *104
0477   00430    74 0004    PASR OTA    *4
0478   00431    14 0002    EBRP OCP    *2
0479   00432    74 0002    PBRP OTA    *2
0480   00433    177772     N6   DEC    -6
0481   00434    0 177740   NBL1 DAC    ST-BL2          NEGATIVE LENGTH OF FIRST LEVEL BOOT
0482   00435    177716     N50  DEC    -50
0483   00436    177610     N120 DEC    -120
0484   00437    0 177604   NBL2 DAC    WAIT-STPC-1     NEG LENGTH OF SECOND LEVEL BOOT
0485   00440    0 02 00540 LOAD LDA    ST              STARTING ADDRESS
0486   00441    000201     SOM  OCT    201
0487   00442    000223     XOFF OCT    223
0488   00443              Z     BSS    1
0489   00444              FADD  BSS    1
0490   00445              LADD  BSS    1
0491   00446              BLCT  BSS    1
0492   00447              WDCT  BSS    1
0493   00450              ZCNT  BSS    1
0494   00451              PNCT  BSS    1
0495   00452              CKSM  BSS    1
0496   00453              NDX   BSS    1
0497   00454              WD    BSS    1
0498   00455              SAVE  BSS    1
0499   00456              SAVA  BSS    1
0500   00457              SAVB  BSS    1
0501   00460              CODE  BSS    1
0502   00461    000000     PON  BSZ    1
0503   00462    000000     RUB  BSZ    1
0504   00463    000200          FIN
       00464     000037
       00465     036000
       00466     177777
       00467     100000
       00470     000001
       00471     000052
       00472     000377
       00473     000222

0505   00474    000000          BSZ    *40
0506                        *
0507                        *          SYSTEM BOOTSTRAP
0508                        *
0509                            ORG    *540
0510   00540    0 000020   ST   DAC    *20             STARTING ADDRESS
0511                        *              1 STA    *57       010057
0512                        *              2 OCP    *000X     03000X
0513                        *              3 INA    *100X     13100X
0514                        *              4 JMP    *-1       002003
0515                        *              5 SNZ              101040
0516                        *              6 JMP    *-3       002003
0517                        *              7 STA    0         010000
0518                        *             10 INA    *100X     13100X
0519                        *             11 JMP    *-1       002010
```

```
0520                          *                                    12 LGL    8           041470
0521                          *                                    13 INA    '000X       13000X
0522                          *                                    14 JMP    *-1         002013
0523                          *                                    15 STA*   0           110000
0524                          *                                    16 IRS    0           024000
0525                          *                                    17 S7E                100040
0526 00541   0 01 00010       JMP    '10                           00020  TO FILL OUT BOOTSTRAP
0527 00542   0 02 00041       LDA    '41                           00021  SET NEXT REENTRY
0528 00543   0 04 00021       STA    '21                           00022  *
0529 00544   0 02 00057       LDA    '57                           00023  SET STARTING ADDRESS
0530 00545   100040           SZE                                  00024  *
0531 00546   0 04 00054       STA    '54                           00025
0532 00547   0 02 00054       LDA    '54                           00026
0533 00550   0 04 00000       STA    0                             00027  *
0534 00551   0 06 00055       ADD    '55                           00030
0535 00552   0 04 00055       STA    '55                           00031
0536 00553   000013           EXA                                  00032
0537 00554   0 02 00013       LDA    '13                           00033  SET IO ORDERS
0538 00555   0 03 00044       ANA    '44                           00034
0539 00556  -0 04 00000       STA*   0                             00035  *
0540 00557   0 12 00000       IRS    0                             00036  *
0541 00560   0 02 00010       LDA    '10                           00037  *
0542 00561   0 01 00015       JMP    '15                           00040  *
0543 00562   0 01 00042       JMP    '42                           00041  SECOND REENTRY
0544 00563   0 04 00025       STA    '25                           00042  CLEAR WORDCOUNT
0545 00564   100000           SKP                                  00043
0546 00565   077777           OCT    77777                         00044
0547 00566   101000           NOP                                  00045
0548 00567   0 02 00051       LDA    '51                           00046  END.  SET UP FINAL REENTRY
0549 00570   0 04 00020       STA    '20                           00047  *
0550 00571   0 01 00010       JMP    '10                           00050  *
0551 00572  -0 01 00054       JMP*   '54                           00051
0552 00573   140040           CRA                                  00052
0553 00574  -0 01 00055       JMP*   '55                           00053  AUTOMATIC LOAD
0554 00575   0 000600         DAC    BL2                           00054  DEFAULT START
0555 00576   000033           OCT    33                            00055
0556 00577   000000           OCT    0                             00056  TERMINATE FIRST SECTION
0557                          *
0558                          *               LOADER
0559 00600   14 0001  BL2     OCP    1
0560 00601   54 0001          INA    1
0561                          *
0562 00602   0 01 00601 WAIT  JMP    *-1
0563 00603   14 0101          OCP    '101                          READER OFF IF ON
0564 00604   0 04 00022       STA    '22
0565 00605   0 05 00775       ERA    STPC                          STOP CODE TEST
0566 00606   100040           SZE
0567 00607  -0 01 00731       JMP*   CHAR
0568 00610  -0 02 00731       LDA*   CHAR
0569 00611   0 05 00655       ERA    SCAN                          TEST FOR SCAN MODE
0570 00612   101040           SNZ
0571 00613   0 01 00632       JMP    ENDT
0572 00614   0 02 00025       LDA    '25
0573 00615   101040           SNZ
0574 00616   0 01 00632       JMP    ENDT                          END FILE EXIT
0575 00617   0 05 00020       ERA    '20
```

```
0576 00620   0416 77        ALR   1
0577 00621   0 05 00021     ERA   '21
0578 00622   100040         SZE
0579 00623   0 01 00630     JMP   EROR
0580 00624   0 04 00025     STA   '25            RESET WORD COUNT
0581 00625   0 10 00731     JST   CHAR
0582 00626   0 12 00024 BUMP IRS  '24            INCREMENT BLOCK COUNT
0583 00627   0 01 00634     JMP   STRT+1
0584 00630   000012     EROR OCT  12             ERROR HALT
0585 00631   0 01 00630     JMP   *-1            HALT AGAIN IF STARTED
0586 00632   000012     ENDT OCT  12             HALT. TAPE LOADED NORMALLY
0587 00633   0 04 00024 STRT STA  '24            RESET BLOCK COUNT
0588 00634   140040         CRA
0589 00635   0 04 00022     STA   '22            RESET CHARACTER BUFFER
0590 00636   0 02 00010     LDA   '10            TEST FOR HIGH SPEED READER
0591 00637   0406 77        ARR   1
0592 00640   100400         SPL
0593 00641   0 01 00652     JMP   SCAN-3
0594 00642   34 0104        SKS   '104
0595 00643   0 01 00642     JMP   *-1
0596 00644   14 0104        OCP   '104
0597 00645   0 02 00766     LDA   ='221
0598 00646   74 0004        OTA   4
0599 00647   34 0104        SKS   '104
0600 00650   0 01 00647     JMP   *-1
0601 00651   14 0004        OCP   4
0602 00652   0 02 00022     LDA   '22
0603 00653   0 01 00655     JMP   *+2            TURN ON TELEPRINTER
0604 00654   0 10 00731     JST   CHAR           LEADER SCAN
0605 00655   0 05 00767 SCAN ERA  ='22           START OF MESSAGE
0606 00656   100040         SZE
0607 00657   0 01 00654     JMP   *-3            *
0608 00660   0 04 00000     STA   0              *
0609 00661   0 04 00025     STA   '25            RESET WORD COUNT
0610 00662   0 02 00024     LDA   '24
0611 00663   0 04 00020     STA   '20            INITIALIZE BLOCK
0612 00664   0 10 00731     JST   CHAR
0613 00665   0 10 00704 DATA JST  SWCH
0614 00666   0 01 00665     JMP   *-1            DO DATA LOAD
0615 00667   0 10 00715     JST   WORD           DO ZERO LOAD
0616 00670   0 05 00765     ERA   =2
0617 00671   0 04 00021     STA   '21
0618 00672   0 05 00020     ERA   '20
0619 00673   0406 77        ARR   1
0620 00674   0 04 00020     STA   '20
0621 00675   140040         CRA
0622 00676   -0 04 00000    STA*  0
0623 00677   0 12 00025     IRS   '25            ADD TO WORD COUNT
0624 00700   0 12 00000     IRS   0
0625 00701   0 12 00021     IRS   '21
0626 00702   0 01 00676     JMP   *-4            ADD TO WORD COUNT
0627 00703   0 01 00665     JMP   DATA
0628 00704   0 00 00052 SWCH PZE  '52            INITIALIZED NONZERO CONSTANT
0629 00705   0 10 00715     JST   WORD
0630 00706   -0 04 00000    STA*  0
0631 00707   0 12 00000     IRS   0
```

```
0632 00710    0 12 00025         IRS   '25              ADD TO WORD COUNT
0633 00711    0 05 00020         ERA   '20
0634 00712    0406 77            ARR   1
0635 00713    0 04 00020         STA   '20
0636 00714   -0 01 00704         JMP*  SWCH
0637 00715    0 00 00052 WORD    PZE   '52              INITIALIZED NONZERO C
0638 00716    140040             CRA
0639 00717    0 04 00021         STA   '21
0640 00720    0 10 00731         JST   CHAR
0641 00721    0 10 00731         JST   CHAR
0642 00722    0 10 00731         JST   CHAR
0643 00723    0414 70            LGL   8
0644 00724    101400             SMI                    TEST FOR ZERO-COUNT WORD
0645 00725    0 12 00704         IRS   SWCH
0646 00726    0 02 00021         LDA   '21
0647 00727    0406 77            ARR   1
0648 00730   -0 01 00715         JMP*  WORD             FIRST TIME IN-RETURN VIA '52
0649 00731    0 000052   CHAR    DAC   '52
0650 00732    0 02 00022         LDA   '22
0651 00733    0414 70            LGL   8
0652 00734    100400             SPL
0653 00735    0 12 00021         IRS   '21
0654 00736    0414 77            LGL   1
0655 00737    0 05 00764         ERA   ='174000
0656 00740    101040             SNZ
0657 00741    0 02 00763         LDA   ='171000
0658 00742    0 05 00762         ERA   ='1000
0659 00743    101040             SNZ
0660 00744    0 02 00761         LDA   ='167000
0661 00745    0 05 00770         ERA   L1
0662 00746    101040             SNZ
0663 00747    0 02 00771         LDA   L2
0664 00750    0 05 00762         ERA   ='1000
0665 00751    101040             SNZ
0666 00752    0 02 00772         LDA   L3
0667 00753    0 05 00773         ERA   L4
0668 00754    0414 76            LGL   2
0669 00755    0 05 00021         ERA   '21              IN ACC. READ NEXT.
0670 00756    0416 72            ALR   6                EXIT ON STOP CODE.
0671 00757    0 04 00021         STA   '21              OTHERWISE TRANSLATE
0672 00760    0 01 00600         JMP   WAIT-2
0673 00761    167000             FIN
     00762    001000
     00763    171000
     00764    174000
     00765    000002
     00766    000221
     00767    000022

0674 00770    002000     L1      OCT   2000
0675 00771    154000     L2      OCT   154000
0676 00772    157000     L3      OCT   157000
0677 00773    176000     L4      OCT   176000
0678 00774    000000             OCT   0
0679 00775    000223     STPC    OCT   223
0680                     *        LOCATION            FUNCTION
```

```
0681                    *                          CHECKSUM
0682                    *          20              ACCUMULATOR
0683                    *          21              ACCUMULATOR
0684                    *          22              CHARACTER BUFFER
0685                    *          24              BLOCK COUNT
0686                    *          25              WORD COUNT
0687                         END
```

```
ADC1   000420   ADC2   000421   BEGN   000002   BGBL   000124
BL2    000600   BLCT   000446   BUMP   000626   C1     000422
CHAR   000731   CHEK   000263   CKLA   000213   CKSM   000452
CODE   000460   CONT   000052   DATA   000665   DECD   000207
DONE   000371   EASR   000427   EBRP   000431   ENBL   000226
ENDT   000632   EPNC   000056   EROR   000630   FADD   000444
GO     000221   HISP   000043   HOB    000325   L1     000770
L2     000771   L3     000772   L4     000773   LADD   000445
LDR    000077   LEAD   000061   LLOP   000070   LOAD   000440
LOOP   000277   MOVE   000147   N120   000436   N50    000435
N6     000433   NBL1   000434   NBL2   000437   NDX    000453
NZ72   000201   OK     000362   ORUB   000116   P      000373
PASR   000430   PBRP   000432   PN     000400   PN88   000401
PNC    000065   PNCH   000331   PNCT   000451   PON    000461
RUB    000462   SAVA   000456   SAVB   000457   SAVE   000455
SCAN   000655   SOCP   000016   SOM    000441   SOTA   000021
ST     000540   STPC   000775   STRT   000633   SWCH   000704
TEST   000306   TF35   000033   TPON   000410   TRNS   000353
WAIT   000602   WD     000454   WDCT   000447   WORD   000715
XOF    000267   XOFF   000442   Z      000443   ZCNT   000450
ZN7    000237
0000 WARNING OR ERROR FLAGS
DAP-16 MOD 2     REV. D     06-28-71
```

467	ADC1	419					
468	ADC2	420C	421	428C	433		
191	BEGN	445J					
276	BGBL	208C	272J	353J			
559	BL2	481	554				
491	BLCT	232C	285	287C			
N 582	BUMP						
474	C1	467					
649	CHAR	254C	567J	568	581J	604J	612J
		640J	641J	642J			
374	CHEK	336J					
331	CKLA	312J					
495	CKSM	286C	297	299C	315	317C	350
		355	357C	361			
501	CODE	190C	197	368			
231	CONT	215J					
613	DATA	627J					
327	DECD	303J	330C	335J			
444	DONE	373J					
476	EASR	203					
478	EBRP	227					
345	ENBL	302J	320J				
586	ENDT	571J	574J				
235	EPNC	204C	228C				
584	EROR	579J					
489	FADD	193C	288	295C	305	310C	331
337	GO	304J	324J				
224	HISP	218J					
408	HUB	414J					
674	L1	661					
675	L2	663					
676	L3	666					
677	L4	667					
490	LADD	196C	333				
252	LDR	237J					
238	LEAD	244C	251J	252J	271J	367J	
245	LLOP	211C					
485	LOAD	259					
386	LOOP	290J	314J	325J	340J	351J	354J
		362J	392J				
295	MOVE	326J	341J				
483	N120	239					
482	N50	283					
480	N6	277					
481	NBL1	257					
484	NBL2	264					
496	NDX	240C	248C	258C	265C	278C	456C
321	NZZZ	307J					
437	OK	212C	423J				
267	ORUB	214C					
446	P	213C	450J	453J	454J		
477	PASR	205					
479	PBRP	229					
451	PN	261J	266J	458J			
452	PN88	260C	262C	263C	455C	457J	

242	PNC	243	279J				
412	PNCH	389J	390J	391J	443J		
494	PNCT	284C	300C	311C			
502	PON	201C	220C	225C	460		
503	RUB	202C	222C	226C	463		
499	SAVA	416C	430	432C	435	437	
500	SAVB	418C	425				
498	SAVE	293	394C	400C	403	405C	440
		442C					
605	SCAN	569	593J				
203	SOCP	223J					
486	SOM	280					
206	SOTA	230J					
510	ST	481	485				
679	STPC	484	565				
587	STRT	583J					
628	SWCH	255C	613J	636J	645C		
393	TEST	387J	402C	407J			
216	TF35	199J					
459	TPON	206C	207C	236J	270J	276J	364J
		366J	466J				
430	TRNS	427J					
562	WAIT	484	672J				
497	WD	321C	339				
492	WDCT	250C	296C	309C	349	360	
637	WORD	256C	615J	629J	648J		
378	XOF	209C	210C	352J	363J	365J	372J
		385J					
487	XOFF	379					
486	Z	234C	291	346C			
493	ZCNT	233C	292C	308C	313	319C	322
		328	338C	345	348C	359C	374
		395					
354	ZNZ	376J	377J				
	=*1000	658	664				
	=*100000	388					
	=*167000	660					
	=*171000	657					
	=*174000	655					
	=*200	410	431				
	=*22	605					
	=*221	597					
	=*222	219					
	=*36000	406					
	=*37	409	417				
	=*377	221	267	382	424		
	=*52	253					
	=-1	398					
	=1	289	332	399			
	=2	616					

97	SYMBOLS
237	REFERS
687	RECORDS
1	N FLAGS